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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/711,259	09/06/2004	Min-Chih Wang	NAUP0574USA	5258

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NORTH AMERICA INTERNATIONAL PATENT OFFICE (NAIPC)
P.O. BOX 506
MERRIFIELD, VA 22116

EXAMINER

LE, DUNG ANH

ART UNIT PAPER NUMBER

2818

DATE MAILED: 07/27/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/711,259

Applicant(s)

WANG, MIN-CHIH

Examiner

DUNG A. LE

Art Unit

2818

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-17 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☐ Claim(s) ____ is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 06 September 2004 is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119.

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. ____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date ____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: ____.

DETAILED ACTION

Oath/Declaration

The oath/declaration filed on 9/6/2004 is acceptable.

Specification

The specification has been checked to the extent necessary to determine the presence of all possible minor errors. However, the applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim Rejections

Set of claims 1- 8

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1 and 4- 8 are rejected under 35 USC 102 (e) as being anticipated by Lee et al. (6486059 B2).

Lee et al. teach a damascene method (Figs. 2A- 2G) capable of avoiding copper extrusion, the damascene method comprising:

providing a semiconductor wafer including a substrate 30 with at least one metal layer on the substrate 32; depositing a dielectric layer 361 on the metal layer 32; forming a damascene recess structure 50 having an opening exposing a portion of the metal layer 32 in the dielectric layer 361/362; performing a degas step to make gas escape from the dielectric layer (col 2, line 45; col 4, line 14 and col 5, line 80); forming a barrier layer 54 on portions of the exposed surface of the metal layer 32 and on the damascene recess structure 50; and forming a conductive layer 36 on the barrier layer.

Regarding claim 4, a passivation layer 34 is formed between the metal layer and the dielectric layer and wherein the passivation layer is substantially made from silicon nitride (col 3, line 47).

Regarding claims 5- 6, the dielectric layer is a laminate compound layer comprising a first low-k dielectric 361, a stop layer 38 over the first low-k dielectric, a second low-k dielectric 362, and a hard mask layer 42/44.

Regarding claim 7, wherein the metal layer is made of copper or tungsten.

Regarding claim 8, the damascene recess structure is a dual damascene recess 50.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 2 is rejected under 35 U.S.C. 103 (a) as being unpatentable over Lee et al. in view of the following remark.

Lee et al. teach the claimed invention as applied to claim 1, except for the gas escaping from the dielectric layer fluorine-containing gas.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to use the dielectric layer is made of fluorine-containing material, because fluorine or carbon doped silicon dioxide or organic-containing low-k materials are commonly used to improve the etching rate, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use.

Claim 3 is rejected under 35 U.S.C. 103 (a) as being unpatentable over Lee et al. in view of Rozbicki et al. (6764940 B1).

Lee et al. teach the claimed invention as applied to claim 1, except for wherein the degas step is an anneal step by heating to a range between 200°C to 300°C.

Rozbicki et al. teach the degas step is an anneal step by heating to a range between 200°C to 300°C. (col 4, lines 55- 60).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to utilize the degas step is an anneal step by heating to a range between 200°C to 300°C. in Lee 's method, in order to improve an adsorption of the plasma source gas ion onto the dielectric insulating layer surface and minimizing thermal shock due to the plasma process.

Set of claims 9- 17

Claims 9, 12-14 and 16-17 are rejected under 35 U.S.C. 103 (a) as being unpatentable over Lee et al. in view of Background of Invention .

Lee et al. teach a damascene method capable of avoiding conductive material extrusion, the damascene method comprising:

providing a substrate (figs. 2A-2G);

forming a dielectric layer 30 having an embedded metal layer 32 therein over the interlayer dielectric;

forming a low-k dielectric film 362 over the dielectric layer 361;

etching a damascene recess structure in the low-k dielectric film, the damascene recess structure 50 communicating the embedded metal layer 32;

executing a degas step to expel gas contained by the low-k dielectric film (col 2, line 45; col 4, line 14 and col 5, line 80);

forming a barrier layer 58 covering surface of the damascene recess structure and surface of the low-k dielectric film; and

depositing a conductive layer 56 over the barrier layer.

Lee et al. do not teach forming a plurality of devices on the substrate ;
forming an interlayer dielectric to encapsulate the plurality of devices; forming a plurality of conductive plugs in the interlayer dielectric to connect the devices on the substrate;

Background of Invention discloses the step of forming a plurality of devices 14 on the substrate; forming an interlayer dielectric 10 to encapsulate the plurality of devices; forming a plurality of conductive plugs 12 in the interlayer dielectric to connect the devices on the substrate.

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to form a plurality of devices on the substrate; forming an interlayer dielectric to encapsulate the plurality of devices; forming a plurality of conductive plugs in the interlayer dielectric to connect the devices on the substrate in Lee.'s method, in order to electrically connect to another conductive area below.

Regarding claim 12, the conductive layer is a copper layer 56.

Regarding claim 13, between the embedded metal layer 32 and the low-k dielectric layer 361/362, a passivation layer 34 is formed.

Regarding claim 14, the passivation layer 34 is substantially made from silicon nitride.

Regarding claim 16, the low-k dielectric film is a laminate compound layer comprising a first low-k dielectric 361, a stop layer 38 over the first low-k dielectric, a second low-k dielectric 362, and a hard mask layer 42.

Regarding claim 17, wherein the damascene recess structure is a dual damascene recess 50.

Claims 10 and 15 are rejected under 35 U.S.C. 103 (a) as being unpatentable over Lee et al. in view of Background of Invention and further in view the following remark.

Lee et al. teach the claimed invention as applied to claim 9, except for the gas escaping from the dielectric layer fluorine-containing gas.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to use the dielectric layer is made of fluorine-containing material, because fluorine or carbon doped silicon dioxide or organic-containing low-k materials are commonly used to improve the etching rate, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use.

Regarding claim 15, Lee et al. in view of Background of Invention disclose the low-k dielectric layer, but fail to disclose wherein the low-k dielectric layer has a dielectric constant (k) that is less than 2.9 as cited in the present claim.

However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to select the low-k dielectric layer has a dielectric constant (k) that is less than 2.9 , since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art.

Claim 11 is rejected under 35 U.S.C. 103 (a) as being unpatentable over Lee et al. in view of Background of Invention and further in view of Rozbicki et al. (6764940 B1).

Lee et al. and Background of Invention teaches the claimed invention as applied to claim 9, except for wherein the degas step is an anneal step by heating to a range between 200°C to 300°C.

Rozbicki et al. teach the degas step is an anneal step by heating to a range between 200°C to 300°C. (col 4, lines 55- 60).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to utilize the degas step is an anneal step by heating to a range between 200°C to 300°C. in Lee 's method, in order to improve an adsorption of the plasma source gas ion onto the dielectric insulating layer surface and minimizing thermal shock due to the plasma process.

When responding to the office action, Applicants' are advice to provide the examiner with the line numbers and page numbers in the application and/or references cited to assist the examiner to locate the appropriate paragraphs.


A shortened statutory period for response to this action is set to expire 3 (three) months and 0 (zero) day from the day of this letter. Failure to respond within the period for response will cause the application to become abandoned (see M.P.E.P 710.02(b)).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dung A. Le whose telephone number is (571) 272-1784. The examiner can normally be reached on Monday-Tuesday and Thursday 6:00am- 4:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Nelms can be reached on (571) 272-1787. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9306 for regular communications and (703) 872-9306 for After Final communications.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

DUNG A. LE 
Primary Examiner
Art Unit 2818